
Self-Reported Frequency of Serum Cholesterol Testing, Awareness of Test Results, and Laboratory Cholesterol Values in Two South Carolina Communities

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Synopsis

Self-reported frequency of cholesterol testing and awareness of test results were collected from 5,246 adults 18 years and older in two semirural communities in South Carolina. Serum cholesterol was also measured for about 60 percent of this group.

More than half of these persons had serum cholesterol values greater than 200 milligrams per

deciliter (mg per dL) and 21 percent had values greater than 240 mg per dL. One-third of the population had had their cholesterol level measured within the past year; 40 percent reported that their cholesterol level had never been measured. Among persons whose cholesterol was 240 mg per dL or more, 39 percent reported that their cholesterol had never been measured or that they did not know if it had been measured, 37 percent reported that their cholesterol had been measured but that they were not told that it was high, and 18 percent reported that their cholesterol had been measured and that they were advised to reduce it.

Among persons whose cholesterol was 200 mg per dL or more, and who reported that they had cardiovascular disease, 25 percent reported that they were advised to reduce their cholesterol. These results emphasize the need to increase the proportion of the population who have had their cholesterol level measured, who know their test results, and who have been properly counseled about the results.

AN ELEVATED serum cholesterol level is one of the major risk factors for ischemic heart disease (IHD) (1). In the last few years, several studies have shown that by reducing the cholesterol level, mortality from IHD can be reduced (2). In industrialized countries, however, over the last 50 years, an increased dietary intake of saturated fats has led to elevated serum cholesterol levels (3). Results from the Second National Health and Nutrition Examination Survey (1976 to 1980) indicated that 57 percent of the U.S. population had cholesterol levels 200 milligrams per deciliter (mg per dL) or higher (4).

The National Cholesterol Education Program (NCEP) (5) proposed that all persons ages 20 years or older should have their serum cholesterol measured and that if it is elevated, lipoprotein analysis should be done, followed by dietary and other

treatment, if needed. Persons who know their cholesterol level may be more motivated to change their diet. Furthermore, screening may identify persons who need drug treatment because of a genetic lipid disorder or inadequate response to dietary therapy.

The South Carolina Department of Health and Environmental Control recently undertook a 5-year project, the South Carolina Cardiovascular Disease Prevention Program, to reduce death and disability due to cardiovascular disease—especially IHD. The short-range goal of the program is to reduce the prevalence of the main risk factors for IHD.

This paper reports the results of a survey in which participants are asked if they had had their cholesterol level measured, what the level was in numbers, and whether they were being treated for an elevated cholesterol level. The serum cholesterol

Table 1. Percentage distribution by selected characteristics of participants from two South Carolina communities

| Category | Interview only (N = 2,296) | Interview and assessment (N = 3,193) |
|--------------------------------|-------------------------------|---|
| Race and sex: | | |
| White men..... | 28.5 | 30.7 |
| White women..... | 49.2 | 44.9 |
| Black men..... | 7.1 | 6.7 |
| Black women..... | 15.2 | 17.6 |
| Ages (years): | | |
| 18-24..... | 15.0 | 7.0 |
| 25-34..... | 24.4 | 20.2 |
| 35-44..... | 21.0 | 23.1 |
| 45-54..... | 11.7 | 16.1 |
| 55-64..... | 10.6 | 15.6 |
| 65 and older..... | 17.3 | 18.0 |
| Educational attainment: | | |
| Less than high school..... | 61.5 | 60.7 |
| High school graduate..... | 21.4 | 19.9 |
| College graduate..... | 17.1 | 19.4 |

level of program participants was also measured and compared with the self-reported information about cholesterol levels.

Methods

Between June 1987 and January 1988, the South Carolina Department of Health and Environmental Control conducted a community health survey of the population of two communities (Florence and Anderson). Details of these surveys have been reported previously (7).

Data collected included information about health behavior, dietary habits, history of medical conditions, knowledge of IHD, risk awareness, and participation in prevention programs.

In the first phase of the survey, participants were asked if their cholesterol level had ever been checked. If so, time since last measurement was asked. Persons who reported that their cholesterol had been measured were also asked if they had been told that their cholesterol level was high. Persons who said yes were asked if they had been advised to reduce their cholesterol level.

History of arteriosclerotic disease was determined by asking the following series of questions: "Have you ever been told by a doctor that you have had a heart attack or myocardial infarction, angina pectoris, stroke or cerebrovascular accident, blocked arteries or arteriosclerosis?" Participants were also asked if their physician had ever told them that they have high blood pressure, diabetes, or sugar diabetes.

Interviewers asked each person to participate in the second phase of the survey—a physical assess-

ment in which heart rate, blood pressure, height and weight, and waist and hip girth were measured. From blood samples levels of total cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, glycosylated hemoglobin, glucose, and apolipoproteins A1 and B were also measured. Total cholesterol was analyzed in the State's laboratory by using the cholesterol oxidase-esterase enzymatic reaction method. Cholesterol measurements were standardized against the Centers for Disease Control Laboratory protocols (7).

Data from both communities were combined for analysis. Analysis of variance was used for continuous variables, and log-linear models were used for categorical variables. All statistical procedures were performed by using SAS (8).

Results

In Florence, 2,753 persons were interviewed (85.6 percent of the surveyed population), and 1,642 participated in the physical assessment. In Anderson, 2,492 persons were interviewed (80.0 percent of the surveyed population), and 1,551 participated in the physical assessment. The population and the sample were evaluated by sex, race (black or white), and age group (18-24, 25-34, 35-44, 45-54, 55-64, and 65 or older) (table 1). When values were compared with 1986 census data, black men ages 18-29 were found to be underrepresented, and white adults ages 65 and older were overrepresented. Therefore, the data are adjusted for sex, race, and age. Although participation rates for physical assessment were not as high as desired, comparisons with the demographic profile of interview respondents and physical assessment participants showed these groups to be similar as well as to the total adult population.

Forty percent of participants reported their cholesterol level had never been measured, but 35 percent reported that it had been measured during the previous year (table 2). Only 2 percent of persons reported that their cholesterol had been measured more than 5 years ago.

Cholesterol measurements were equally as common among men as among women but less common among blacks than whites ($P < 0.001$) (table 2). The prevalence of cholesterol measurements increased with years of education ($P < 0.001$) and age ($P < 0.001$) (fig. 1). The effect of education was more marked among whites than blacks ($P < 0.05$).

Persons who reported physician-diagnosed arteriosclerotic disease were more likely than those who did not to report that their cholesterol level had

Table 2. Most recent serum cholesterol measurement, by percentage of race and sex

| Time of measurement | White men (N = 1,623) | White women (N = 2,546) | Black men (N = 375) | Black women (N = 906) | Total (N = 5,450) |
|---------------------------------|--------------------------|----------------------------|------------------------|--------------------------|----------------------|
| Past year | 37 | 38 | 27 | 28 | 35 |
| 1-2 years ago | 10 | 9 | 7 | 6 | 8 |
| 3-5 years ago | 4 | 3 | 2 | 2 | 3 |
| More than 5 years ago | 2 | 2 | 2 | 1 | 2 |
| Never measured | 36 | 36 | 51 | 52 | 40 |
| Do not know | 11 | 12 | 11 | 11 | 11 |

NOTE: Log-linear model: race $P < 0.001$; sex not significant.

Table 3. Most recent serum cholesterol measurement, by history of arteriosclerotic diseases,¹ diabetes, and ischemic heart disease risk factors

| Time of measurement | Arteriosclerotic disease (N = 514) | Diabetes (N = 333) | Diabetes (pills) (N = 125) | Diabetes (insulin) (N = 116) | High blood pressure ² (N = 1,501) | Smoking (N = 1,512) |
|---------------------------------|---------------------------------------|-----------------------|-------------------------------|---------------------------------|---|------------------------|
| Past year | 57 | 44 | 50 | 48 | 46 | 32 |
| 1-2 years ago | 7 | 7 | 6 | 5 | 98 | |
| 2-5 years ago | 4 | 3 | 2 | 0 | 3 | 3 |
| More than 5 years ago | 1 | 2 | 2 | 2 | 2 | 1 |
| Never measured | 17 | 28 | 18 | 26 | 26 | 45 |
| Do not know | 14 | 15 | 22 | 19 | 14 | 11 |

¹ Heart attack, angina pectoris, stroke, or arteriosclerosis. ² Diagnosed by a physician.

been measured (table 3). However, 31 percent of those reporting arteriosclerotic disease reported that their cholesterol had not been measured or that they did not know if it had been measured. The same responses came from 40 percent of persons reporting high blood pressure, 56 percent of smokers, and 43 percent of persons with diabetes.

The mean cholesterol level (207 mg per dL) did not differ by race among participants whose total serum cholesterol level was measured (fig. 2). Furthermore, the mean increased from 170 mg per dL for the youngest age group (18 to 24 years old) to 220 mg per dL for the middle-aged group (45 to 54 years old). The difference by sex was small before middle age (fig. 2); however, for men, the value stabilized at about age 50, but for women, it continued to increase for another decade (fig. 2). The highest levels were for women ages 55 to 64 years.

One-third of the men (32 percent) and women (31 percent) had cholesterol levels of 200 to 239 mg per dL, and 18 percent of the men and 22 percent of the women had levels 240 mg per dL or higher (fig. 3). The proportion of persons with an elevated cholesterol level increased with age. Among men, cholesterol levels greater than 200 mg per dL were most prevalent during ages 45-64 (about 60 percent), whereas the highest prevalence among women (80 percent) occurred 10 years later—after

Table 4. History of cholesterol testing and counseling, by cholesterol level

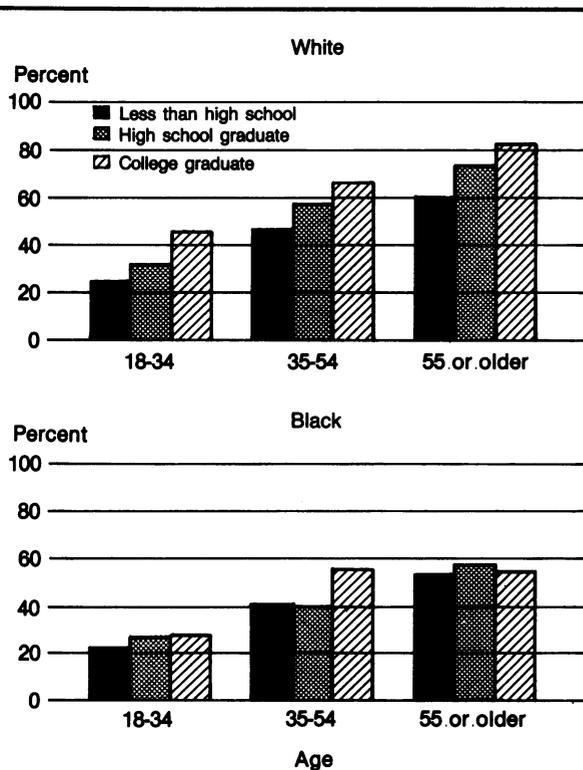
| History | < 200 mg per dL (N = 1,525) | 200-239 mg per dL (N = 1,012) | > 240 mg per dL (N = 656) |
|-----------------------------------|-----------------------------------|-------------------------------------|---------------------------------|
| Not measured | 46 | 36 | 29 |
| Do not know if measured | 11 | 10 | 11 |
| Not told of high level | 39 | 44 | 36 |
| Told of high level: | | | |
| No advice given | 3 | 2 | 6 |
| Advised to reduce | 2 | 8 | 18 |

the menopause. This pattern did not differ by race (data not shown).

Among persons whose cholesterol level was greater than 240 mg per dL, 39 percent reported that their cholesterol level had never been measured or that they did not know if it had been measured (table 4). Thirty-seven percent had not been told that their level was high. Three-fourths of the 24 percent of persons whose cholesterol level was high had been advised to lower their cholesterol.

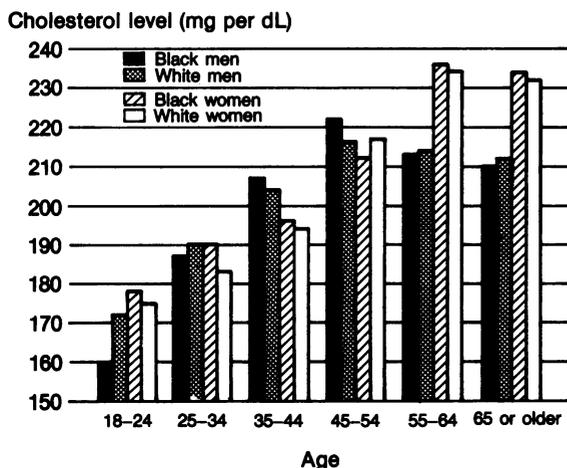
Of the persons whose cholesterol level was greater than 200 mg per dL, 221 reported a history of arteriosclerotic disease. Among these persons, 40 percent had not been told that their cholesterol was high, 29 percent reported that their cholesterol had never been measured or that they did not know if it had been, and 31 percent had been told that their

Figure 1. Percentage of persons who had their serum-cholesterol level checked, by race, age, and educational attainment¹



¹In long-linear models, age $P < 0.001$, race $P < 0.001$, and race and educational interaction $P < 0.05$.

Figure 2. Mean cholesterol level by race, sex, and age¹



¹Age, $P < 0.001$; race $P < 0.001$; sex, $P < 0.001$; race, not significant; age and sex interaction, $P < 0.001$.

cholesterol level was high. About 80 percent of persons in the last group had been advised to reduce their high level.

Among 202 persons with diabetes and cholesterol levels of 200 mg per dL or more, 43 percent had not been told that their cholesterol was high, 42 percent reported that their cholesterol had never been measured or they did not know if it had been measured, and 15 percent had been told that their cholesterol level was high.

Discussion

About half of the adult population in two South Carolina communities had serum cholesterol levels greater than 200 mg per dL. Twenty percent of the population had a cholesterol level greater than 240 mg per dL, a level that is associated with a high risk of IHD.

In 1985, recommendations for desirable serum cholesterol levels were issued (9). The recommendation of less than 200 mg per dL was appreciably lower than the level physicians generally considered threatening to their patients' health. Thus, because of this perception by physicians and the general public, it is not surprising that in our 1987-88 study 40 percent of persons with cholesterol levels of 200 mg per dL or more had never been told their cholesterol level was high. This proportion is slightly better than the results of the 1985-86 Minnesota Heart Survey; 66 percent of whites and 80 percent of blacks surveyed did not know that their cholesterol level was high (10).

The relative improvement in cholesterol awareness seen in these community surveys may be reflective of intervention efforts targeting cholesterol screening and awareness. Since the completion of the initial surveys in these two South Carolina communities, further intervention efforts have been initiated in one of the two communities to increase cholesterol screening and awareness. In addition, at the time of the initial surveys in these two communities, the NCEP was just being implemented nationally. Findings from repeat surveys in both communities that were carried out in early 1992 are currently being analyzed. The results should permit an evaluation of the impact of NCEP and of the specific intervention efforts in these two South Carolina communities.

Our results indicate the need to reach specific population groups. These groups include persons with IHD or risk factors for IHD, persons with less education, and black Americans. However, since less than half of the population reported that they

had ever had their cholesterol measured, cholesterol testing should increase in the general community—not only among certain groups. One-third of the population reported they had had their cholesterol measured in the previous year; in theory, the whole population could be measured in 3 years. However, many of the same people may be using services repeatedly, thus reducing the likelihood that the other two-thirds of the population will have their cholesterol measured.

In contrast, many people in the general population have had many opportunities to have their blood pressure measured, and a significant proportion of the population knows whether their most recent blood pressure measurement was high, low, or normal (11). The screening strategy used for controlling blood pressure, which has been very successful, has not been used for reducing cholesterol levels. Large scale programs for cholesterol measurement and dietary counseling could greatly reduce a population's mean serum cholesterol level and mortality from IHD.

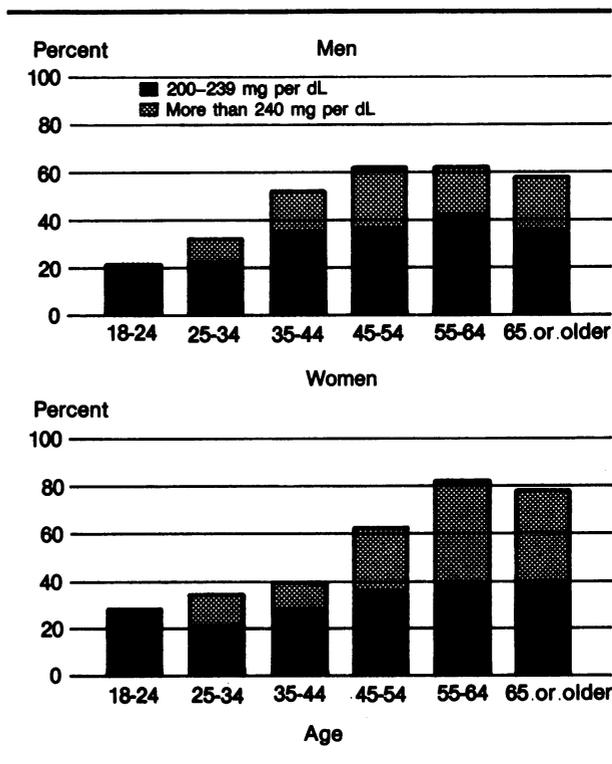
In a study of nonpharmacologic cholesterol reduction programs at worksites, Bruno and colleagues found that persons treated made a greater reduction (6.4 percent) of their total serum cholesterol level than did controls (12). In contrast, Aronow and coworkers (13) found that screening and short-term counseling did not affect risk factor prevalence.

The Minnesota Heart Health Program was organized to reduce IHD risk factors through systematic screening and education (14). In that program, the mean serum cholesterol level was 2.1 percent lower for persons in the treatment group than in the control group. Some of these data suggest that systematic risk-factor screening and education may help lower the risk for IHD in a given population.

These studies do not estimate the impact of the NCEP's proposed changes in medical practice, in which routine serum cholesterol screening and followup are to be integrated into regular health care. In the North Karelia Project in Finland, for example, the greatest changes in cholesterol levels were found for persons who had a personal physician or public health nurse counsel them about lowering their cholesterol level (15).

Physicians should be encouraged to counsel patients according to the new cholesterol guidelines (5,9). Because cholesterol levels have generally been measured only among persons with a cholesterol-related disease and because the accepted normal level was previously much higher, physicians appear not to counsel their patients until levels are

Figure 3. Percentages of persons with cholesterol levels of 200-239 or 240 or more milligrams per deciliter (mg per dL), by sex and age



extremely high. This pattern will hopefully be altered by implementing the NCEP guidelines. These guidelines are intended to assist physicians in counseling patients who have elevated serum cholesterol levels and diseases such as IHD, diabetes, or hypertension.

Volunteers and nurses have successfully conducted cholesterol screening and counseling (16). However, these health care personnel need strong support from the medical community both in screening and followup and in maintaining adequate technical levels in measurements and counseling techniques. Physicians will continue to treat patients at higher risk for IHD and hypercholesterolemia, and patients for whom dietary counseling is inappropriate and drug treatment indicated.

Cholesterol screening and counseling will best serve a community when they are supported by other activities, such as a community-wide cholesterol awareness and education campaign. Substantial knowledge and skills, which are needed for dietary change, can be taught and reinforced through mass media campaigns (17). Changes in the environment, such as availability of healthful foods, are important in supporting a strategy

designed to change a population's mean serum cholesterol level (18).

Previous studies indicate that diet is the most significant lifestyle factor affecting the serum cholesterol level. To lower serum cholesterol levels, people must consume fewer saturated fats, substituting these with monounsaturated and polyunsaturated fats. In addition, a greater proportion of the total calories should come from complex carbohydrates.

Changing the diet of the nation's population will necessarily alter agricultural policy and food marketing. Thus, any change in public health policy will require a large scale consensus. The medical community alone cannot bring about these changes in society, and persons will not change their diet without individual motivation. Community-wide serum cholesterol measurement and education may help provide such motivation.

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